

Serial No.: 10/814,672
Examiner: Mark O. Budd
Reply to Office Action of January 25, 2005

Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the subject application.

Listing of Claims:

1. (cancelled)
2. (cancelled)
3. (cancelled)
4. (cancelled)
5. (cancelled)
6. (cancelled)
7. (cancelled)
8. (cancelled)
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12. (cancelled)
13. (cancelled)
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16. (cancelled)
17. (cancelled)
18. (cancelled)
19. (cancelled)
20. (cancelled)

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21. (cancelled)
22. (cancelled)
23. (cancelled)
24. (cancelled)
25. (cancelled)
26. (cancelled)
27. (cancelled)
28. (cancelled)
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32. (cancelled)
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36. (cancelled)
37. (cancelled)
38. (cancelled)
39. (cancelled)
40. (cancelled)
41. (cancelled)
42. (cancelled)
43. (currently amended) A system for delivering ultrasonic energy to a liquid, comprising:
 - A. two or more ultrasonic transducers adapted for coupling to said liquid, wherein

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- (i) each ultrasonic transducer is capable of producing ultrasonic energy in said liquid at two or more resonant frequencies, each resonant frequency being within a range of frequencies ~~associated with that resonant frequency~~, said range of frequencies extending about said resonant frequency, and
 - (ii) the two or more ultrasonic transducers are electrically coupled;
- B. two or more ultrasonic generators, each ultrasonic generator being adapted for producing a drive signal within one of the ranges of frequencies associated with one of the two or more resonant frequencies;
- C. a multiplexer for receiving the drive signals from the two or more ultrasonic generators and for electrically coupling the received drive signals, one at a time in a time sequence, to the electrically coupled two or more ultrasonic transducers; and
- D. a controller for controlling the multiplexer in a first state, so that one of the two or more ultrasonic generators drives the coupled two or more ultrasonic transducers to produce ultrasonic energy in said liquid characterized by a frequency that sweeps across one of the frequency ranges, and

in a second state, so that another of the two or more ultrasonic generators drives the coupled two or more ultrasonic transducers to change frequency to a different frequency range, to produce ultrasonic energy in said liquid characterized by a frequency that sweeps across at least another of the frequency ranges.

44. (previously presented) A system according to claim 43, wherein each of the two or more ultrasonic transducers is capable of producing the same two or more resonant frequencies as all of the other two or more ultrasonic transducers.
45. (previously presented) A system according to claim 43, wherein the two or more resonant frequencies include a fundamental frequency and one or more harmonic frequencies.
46. (previously presented) A system according to claim 43, wherein the two or more resonant frequencies includes a first frequency of about 40khz, a second frequency of about 72khz, and a third frequency of about 104khz.
47. (previously presented) A system according to claim 43, wherein at least one of the two or more ultrasonic generators further produces a drive signal characterized by a frequency that

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sweeps, at a first sweep rate, within one of the ranges of frequencies associated with one of the two or more resonant frequencies.

48. (previously presented) A system according to claim 47, wherein the ultrasonic generator further sweeps the first sweep rate at a second sweep rate.

49. (previously presented) A system according to claim 43, wherein the controller controls the multiplexer to one of the first state or second state as a predetermined function of a particular chemistry of the liquid.

50. (previously presented) A system according to claim 43, further including clamping means for applying compression to at least one of the two or more ultrasonic transducers.

51. (currently amended) A system for delivering ultrasonic energy to a liquid, comprising:

- A. two or more ultrasonic transducers adapted for coupling to said liquid, wherein
 - (i) each ultrasonic transducer is capable of producing ultrasonic energy in said liquid at two or more resonant frequencies, each resonant frequency being within a range of frequencies ~~associated with that resonant frequency~~, said range of frequencies extending about said resonant frequency, and
 - (ii) the two or more ultrasonic transducers are electrically coupled to a common input;
- B. two or more ultrasonic generators, each ultrasonic generator being adapted for producing a drive signal within one of the ranges of frequencies associated with one of the two or more resonant frequencies;
- C. a multiplexer having at least two states, for receiving the drive signals from the two or more ultrasonic generators and in response to an applied control signal, for electrically coupling the received drive signals, one at a time in a time sequence, to the common input of the electrically coupled two or more ultrasonic transducers; and
- D. a controller for generating the control signal and applying the control signal to the multiplexer so that
 - (i) in a first state, the drive signal from one of the two or more ultrasonic generators drives the coupled two or more ultrasonic transducers to produce

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ultrasonic energy in said liquid characterized by a frequency that sweeps across one of the frequency ranges, and

(ii) in a second state, the drive signal from another of the two or more ultrasonic generators drives the coupled two or more ultrasonic transducers to change frequency to a different frequency range, to produce ultrasonic energy in said liquid characterized by a frequency that sweeps across another of the frequency ranges.

52. (previously presented) A system according to claim 51, wherein each of the two or more ultrasonic transducers is capable of producing the same two or more resonant frequencies as all of the other two or more ultrasonic transducers.

53. (previously presented) A system according to claim 51, wherein the two or more resonant frequencies include a fundamental frequency and one or more harmonic frequencies.

54. (previously presented) A system according to claim 51, wherein the two or more resonant frequencies includes a first frequency of about 40khz, a second frequency of about 72khz, and a third frequency of about 104khz.

55. (previously presented) A system according to claim 51, wherein at least one of the two or more ultrasonic generators further produces a drive signal characterized by a frequency that sweeps, at a first sweep rate, within one of the ranges of frequencies associated with one of the two or more resonant frequencies.

56. (previously presented) A system according to claim 55, wherein the ultrasonic generator further sweeps the first sweep rate at a second sweep rate.

57. (previously presented) A system according to claim 51, wherein the controller controls the multiplexer to one of the first state or second state as a predetermined function of a particular chemistry of the liquid.

58. (previously presented) A system according to claim 51, further including clamping means for applying compression to at least one of the two or more ultrasonic transducers.